Computer translation of EP 0700737
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The invention relates to a method to the production of an evaporator with partial enlarged and different duct cross sections for a compressor cooler, existing from at least two metallic with one another fixed sheet metals connected in form of a weld or a soldering, whereby first the formation of a coolant channel of uniform cross section mäanderförmig longitudinal between the sheet metals portions of the connected with one another sheet metals become formed by internal pressure channels.

Such evaporators become the formation of a refrigerating chamber regular from corresponding planar evaporated plates formed, which limit several cooling spaces of a refrigerator single in each case after the transformation and in the installation condition or or multilateral and form frequent enclose also the rear wall of such a refrigerating chamber.

Such evaporated plates and their production after the so called roll bond method are in the DE-PS 15 52 044 exemplified.

With the roll bond method, connected with one another with which the two layers of the circuit board become by a rolling welding bottom stretch of the substrate, by separating layers from weldingpreventing material for the later course of the coolant channel formed exact limited flat ones one provides. This measure is for example in the DE-PS 19 20 424 described.

The formation made usually by compressed air, which between the not welded channel areas passed becomes and over the there resultant internal pressure one or both welded together circuit boards the formation of duct cross sections a deformed.

As refrigerant only hydrocarbon (FCKW) became used materials usually FCKW free during present newer cooling systems like e.g. in the past. Butane use.

▲ top These refrigerants form however when simmering about twice as much gas like the conventional refrigerants and are therefore related to the resultant pressure level and again the becoming relaxation in its behavior very different, necessary of these high compression phases, to the prior refrigerants.

By the formed large amount of gas and the high pressure resultant from it the usually used cross sections of the cooling passages lead by their throttle effect to a pressure drop, which pulls the strong cooling of the surroundings conventional with adiabatic relaxation. In addition still if cross-section contractions, for example at bends of the circuit board or at connecting or pieces of execution, arise then the effect described above develops into the performance of the refrigerator impairing mass. It made here either a cooling in regions of the cooling spaces, which no cool-good contains and close are because of the edges, or it made a cooling of insulation material located in clearances. This again lowers among other things the insulating capacity of these materials.

From this reasons already tried became to increase the critical cross sections of the coolant channels. The only way however, which existed for this so far, required complete other manufacturing process for the cooling agent plates. With necessary the for this Z-bond-method, with which a finished becomes, from two aluminium layers and a zinc layer located between them existing sand yielding plate of a Coil cut, surrounded two tool tools the fixed heated piece of plate provided with the cooling duct cross sections as reaming.

Into the region of the first molten zinc layer then an excess pressure introduced, that the aluminium layers located between the tool plates into the tool recesses, becomes i.e. into the milled out recesses presses.

To that the tools are then provided late critical locations which can be expected with larger reaming, so that the duct cross section accepts corresponding extents.

This method conditional however very high tooling expenses and is only in small measures flexible in the cases, in which for small series or for special cool forms of enlarged cross sections at others than at the large excluded locations provided present in the tool to become to have.

It existed thus for the invention the object to suggest a method to the production of partial enlarged and different duct cross sections with the production of from at least two metallic with one another fixed sheet metals of existing evaporator connected in form of a weld or a soldering which lets flexible enlargements partial at arbitrary locations plan and in all conventional methods to the production such from welded circuit boards existing evaporator is more applicable and which can become with small effort at mechanical engineering and forming tools a performed.

Dissolved one becomes this object by the features of the principal claim. Large favourable formations and applications of the method are in the secondary claims and/or. Unteransprüchen present.

With the method after first forming out of the coolant channels the too partial enlargement of the duct cross section already specified intended regions of the coolant channel of an heating are submitted and the coolant channel again with an internal pressure applied, which second partial forming out one or both sheet metals effected. Thereby it can possible be attained by targeted firmness change of the materials which is made by warm bringing in bottom simultaneous application of the cooling passages with internal pressure partial and accurate in expansion and length controllable flares of single portions of the cooling passage.

As a result of the not heated surrounding cross sections, which take over here the support function of the otherwise absolutely necessary outer tool, arises a most simple and effective procedure, which is most flexible also for small series, even for single attempts and prototype production suitable.

In particular is suitable the method in advantageous manner for evaporated plates, which are manufactured after the so called roll bond method and are not during their entire manufacture on outer tools instructed, which contained for instance the form of the coolant channels as reaming.

Thereby the advantage results that for the partial flares on the long-known moulding process within tools does not have to be avoided, which would make the production with the roll bond method for such application purposes uneconomic. By the procedure according to invention and their flexibility to the application with each method here a possibility is provided to accomplish also further without surrounding forming tools flares partial.

To the control of the respective expansion degree and/or. to the restriction of the flare on or the other sheet metal side is favourable it that the regions of the coolant channel only of an heating applied planned to the partial enlargement of the duct cross section on the outside of a Metallbleches are submitted.

If the evaporated plate from sheet metals same strength is manufactured, one weakens one of the two sheets with this formation in particular, so that a partial flare by an overstretching of this sheet metal made, while the other sheet keeps further its supporting function and only insignificantly additional stretched becomes.

Other optimized will can this formation by the fact that the two sheet metals consist different strength also to each other of different metals or metal alloys. Thus can become the supporting effect or other sheet metal an increased or a lowered and become the respective flare on one or on both sides in certain percentages distributed.

In particular if the regions of the coolant channel planned to the partial enlargement of the duct cross section are submitted on the outside from a metal or of the sheet metal applied heating existing from a metal alloy of higher strength, the effect can be reached that the sheet of higher strength becomes only little, the sheet of lower strength however more stretched and thus the duct cross section the region of the sheet metal low strength displaced. This has advantages regarding later bends or regarding the future installation situation.

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Favourable way is the circuit board so constructed that a low strength consists the exhibiting sheet metal of pure aluminium and the other one, a higher strength exhibiting sheet metal of an aluminium alloy. Thus the necessary temperatures become very small and fine more tunable into the region below 400 DEG C placed and a simultaneous influenceableness of the strength of the aluminium by the addition of alloying elements with one of the sheet metals provided.

A particularly favourable formation of the aluminium alloy included max. 25 Gew. - % zirconium (Zr) and as remainder aluminium.

By the zirconium merged in the lattice structure of the aluminium the "softening temperature" shifts over approx. 40 DEG C upward, so that becomes achieved for the controllability of the formation of channels on or on the other sheet metal side necessary safe distance between the points of soft of the two aluminium sheets.

In this connection made favourable-proves the heating up to a minimum temperature of 330 DEG C, applied on the outside of the aluminium alloy. Thus one receives the procedure-safe cross section enlargement of the coolant channels in the type that the aluminium alloy becomes related to the channel diameter around 10%, the pure aluminium related to the diameter around 40% extended.

On particularly simple manner the heating can be reached by the fact that the duct cross sections are in the region of the partial enlargement formed as resistance leaders of an electric circuit.

With this type of the procedure training the beginning and the end of the partial region which can be expand in each case will provide with live pole pieces, whereby the sheet metal range between the pole pieces up to a temperature heated examinable by pyrometers becomes and the internal pressure-flared made.

A minimum pressure put on of 6 bar for the second formation to the partial enlargement of the duct cross section results in a brisk, but not uncontrolled taking place flare in advantageous manner in the case of a corresponding heating and prevented material thinning oversize thereby.

In advantageous manner the internal pressure transforming can become by the fact supported that only becomes applied in the region of the partial enlargement an auxiliary tool, which supports both sheet metals and which assignable material flow keeps.

With small flares it is sufficient to only guarantee the support in the connected with one another regions of the sheet metals and to prevent thus a breaking already before of the finished metallic group of the sheet metals.

After this method of formed evaporators for a compressor cooler, which or a single in each case limited or multilateral encloses several cooling spaces of a refrigerator, exhibits the partial extensions of the cooling agent duct cross section in the regions, which are outside of the cooling spaces or in transition regions between cooling spaces.

Thereby becomes in unwanted regions of the refrigerator and/or. in edges or corners of the refrigerating chamber as well as a cooling of insulating materials between the single cooling spaces prevented.

A just as favourable formation of the evaporator consists of the fact that also are present within the range of bends or bent sections of the evaporated plate partial extensions of the cooling agent duct cross section. These can be with an evaporated plate, which encloses for example a cooling space of four sides, in each case over the whole width of the circuit board in all duct cross sections located in the bend present.

In the long run advantages result, if the partial extensions of the cooling agent duct cross section are in the region of the duct connections at the cooling agent inlet or at the cooling agent discharge opening present. In these regions usually a capillary line for the compressed refrigerant is guided by the inner portion of the coolant channel, so that to the removal of the refrigerant only ring cross section exists around this capillary. In order to compensate the thereby present cross section decrease, it can be trained in particularly advantageous manner of the evaporators in such a way that these regions are provided with partial extensions.

On the basis an embodiment in form of an evaporator manufactured with the invention process the invention is to become more near explained.

Show:

Fig. 1 one with the invention process manufactured evaporated plate before the incorporation into a cool housing
Fig. 2 an enlarged embodiment of the section of A-B of the Fig. 1
Fig. 3 an evaporated plate incorporated in a cool housing.

In the Fig. 1 one recognizes the evaporated plate 1 with their different cooling surfaces 2 and 3 as well as with the connecting webs 4 and 5 located in the other installation method in the region of the bends.

Within the evaporated plate mäanderförmig the cooling passage 6 runs.

The Fig. some enlarged portions of the cooling passage, once in the region of the bars and in the region that shows 2 late circuit board located in the cooling space. Here the portions 7 and 8 of the cooling passage are 6 extended partial with the invention-measured method and a wise essential larger cross section up, than the portions 9 and 10 located in the region of the later interior cooling surface.

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Thereby, like already, an undercooling of the land areas prevented and the maximum cooling performance are described within that late plate parts located in the cooling space more useful.

The Fig. another evaporated plate 11, which 12 disposed within a schematic represented refrigerating chamber is and is against the surroundings with the help of the housing insulation 13 sealed, shows 3.

Also this evaporated plate 11 exhibits curved land areas 14, 15 and 16, which are finally 18 connected outside of the refrigerating chamber over the piping 17 with the compressor.

The land areas 14, 15 and 16 show again a larger cooling duct cross section, that also here about in the Fig. corresponds to 2 represented cross sections 7 and 8. In the evaporated plate 11 is only a single flare provided, which thereby the cross sections 9 and 10 a corresponding cooling passage included.

Again the advantage develops also here that in curved portions no cross-section contraction and thus none to strong undercooling take place. Thus compressor capacity becomes one particularly high proportion at the evaporator more useful.

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Result Page

1. Method to the production of an evaporator with partial enlarged and different duct cross sections for a compressor cooler, existing from at least two metallic with one another fixed connected with one another sheet metals in form of a weld or a soldering, whereby first the formation of a coolant channel of uniform cross section mäanderförmig longitudinal between the sheet metals portions of the connected with one another sheet metals become formed by internal pressure channels,
thus characterized,
that after first forming out the coolant channels the regions of the coolant channel of an heating provided to the partial enlargement of the duct cross section are submitted and the coolant channel with an internal pressure applied become again, which second, partial limited forming out one or both sheet metals effected.

2. Method to the production of an evaporator with partial enlarged and different duct cross sections for a compressor cooler, existing from at least two metallic with one another fixed sheet metals connected in form of a weld or a soldering, whereby first to the formation between the sheet metals mäanderförmig longitudinal of a coolant channel the later course of the coolant channel an exact illustrating and in the surface limiting weldingpreventing material on at least one of the sheet metals on that the other sheet metal of facing side applied will and afterwards the two sheet metals become through in the warm one taking place rolling welding bottom stretch of the substrate and bottom formation or inclusion of a cooling agent inlet and/or a cooling agent discharge opening connected with one another, and with after the connection of the two sheets in first forming out the not welded regions for the coolant channels through Internal pressure channels formed become,
thus characterized,
that after first forming out the coolant channels the regions of the coolant channel of an heating provided to the partial enlargement of the duct cross section are submitted and the coolant channel with an internal pressure applied become again, which second, partial limited forming out one or both sheet metals effected.

3. Process according to claim 1 or 2,
▲ top thus characterized,
that the regions of the coolant channel only of an heating applied planned to the partial enlargement of the duct cross section on the outside of a Metallbleches to be submitted.

4.Verfahren according to claim 1 to 3,
thus characterized,
that the two sheet metals from different metals or metal alloys different strength exist also to each other.

5. Process according to claim 4,
thus characterized,
that the regions of the coolant channel provided to the partial enlargement of the duct cross section on the outside from a metal or of the sheet metal applied heating existing from a metal alloy of higher strength to be submitted.

6. Process according to claim 4 or 5,
thus characterized,
that a lower strength consists the exhibiting sheet metal of pure aluminium and the other one, a higher strength exhibiting sheet metal of an aluminium alloy.

7.Verfahren according to claim 6,
thus characterized,
that the aluminium alloy maximum 0.25 Gew. - % zirconium (Zr) and in the remainder of aluminium consists.

8. Process according to claim 7,
thus characterized,
that the heating up to a minimum temperature of 330 DEG C made, applied on the outside of the aluminium alloy.

9. Process according to claim 1 to 8,
thus characterized,
that the heating by the fact made that the duct cross sections are in the region of the partial enlargement formed as resistance leaders of an electric circuit.

10. Process according to claim 6 to 9,
thus characterized,
that the second formation to the partial enlargement of the duct cross section with a minimum pressure of 6 bar of made.

11. Method after one of the preceding claims,
thus characterized,
that the second formation in a tool made supporting both sheet metals.

12. Process according to claim 11,
thus characterized,
that the support by the tool in the connected with one another regions of the sheet metals made.

13. Process according to claim 11 or 12,
thus characterized,
that the support a lower strength of the exhibiting sheet metal by a hydraulic medium made.

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